Trigger system changes for NP04

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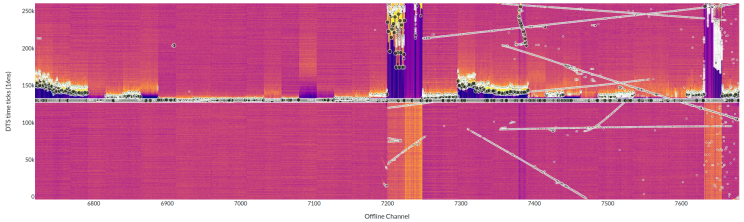
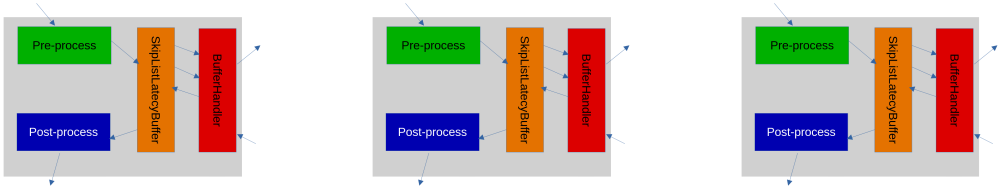
DEEP UNDERGROUND
NEUTRINO EXPERIMENT

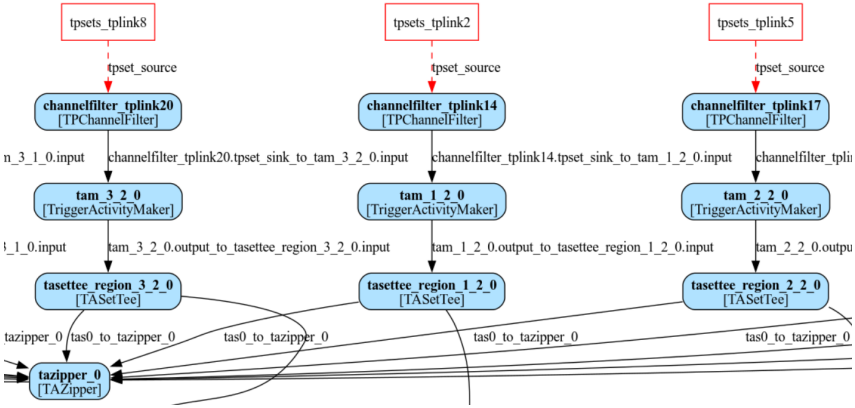
- NP04 TPG/trigger commissioning has been very eventful:
  - DUNE DAQ meeting last week: https://indico.fnal.gov/event/64925/
  - Higher TP rates than initially expected.
  - Readout, trigger, tpwriting systems not keeping up.
  - Trigger: Memory leak, inadequate monitoring, TAs out of order.
  - Hardware issues: APA1 not biased properly, >1 Hz hardware blips, potential 10 cm objects in the volume, etc.



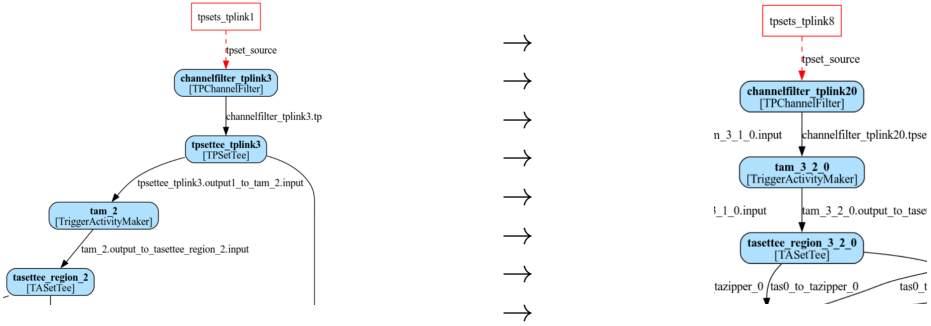
- This (short) talk concentrates on the changes done to the triggering system, and changes to be made.



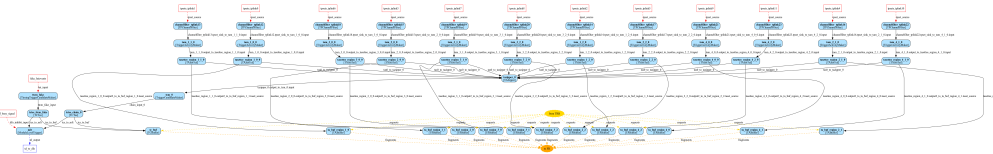
- Readout system has changed from processing all 40 TP producers in 1 TPSet producer, to TPSet producer per plane.
- This means trigger initialises TAMaker for each plane separately, TAZipper merges across APAs & planes.
- Not many changes were needed to the online trigger, but replay & emulation potentially broken.



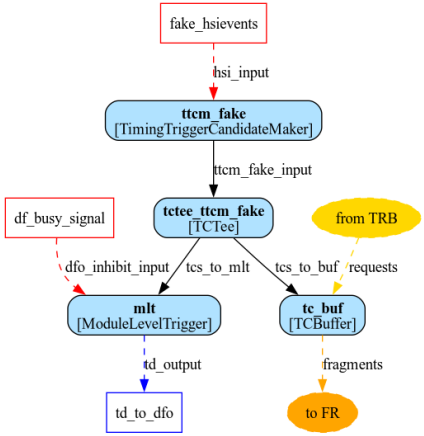
- Performance boost for readout: splits tp_handler workload into three.
- Performance boost for trigger: splits TA-making workload into three.
- Performance boo for trigger: TC-maker now sees 3x many *links*.
- Physics boost for trigger?: We can now make a TC-maker that merges across planes.



- TriggerPrimitive buffers gone from the trigger. Still exist in the readout.
- Means no duplicated TPs in the saved data!
- Also removes the bottleneck at TPSetTee...



- Added ability to not run software triggering when TPG is on.
- In the past, we would “disable” swtrg by using high prescale & mlt-mask...
- Extra flag in the config, ‘use_software_trigger’, true by default.
- Annoying trigger warnings gone when we are not running with the swtrg...
- PR incoming today.



- W.I.P. Online latency based on system-time vs TP/TA/TC start-time.
- Some caveats with replay application, but should work for online.

- We will be testing it live soon!
- PRs made, with some small changes still expected.

1. More comprehensive online monitoring.
   - Almost done, need to test & get help from Marco with grafana.
   - Extra monitoring of the TAZipper's occupancies, all the trigger buffers.
2. Fix trigger memory leak:
   - VTune & test if removing TC/TA buffers helps.
   - If it does, then we suspect issue with TC/TA wrappers.
3. Forcing TAMakers to send TAs as soon as TA is created.
   - Currently need to wait for the next TA.
   - We have different TA rates per APA.
   - So one APA keeps giving us tardy TAs.
   - Also need to double-check TAZipper logic.
4. We need algorithms that process TPs in less than 1 µs.
   - Work already ongoing for ADCSimplewindow, identified areas for improvements for few other.

BACKUPS